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NEW TECHNIQUE OF MACHINING HIGH PRECISION MIRROR SURFACE PRESS ROLLER

by

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NEW TECHNIQUE OF MACHINING HIGH PRECISION MIRROR SURFACE PRESS ROLLER

Deng Hongsen, Second Jinan Motor Vehicle Remodeling Plant

Technical terms for the main topic: press roller and mirror surface machining

High precision mirror surface press roller machining technique of corrosion- and grinding-proof is one of the key techniques that the production enterprises as well as the machining and manufacturing plants of the following industries sought to resolve for a long time: plastics, papermaking, rubber, film and chip production.

In October 1984, the author's plant used a new comprehensive machining technique of metal brush coating, grinding with abrasive belt, as well as buffing to conduct nearly 20 experiments. In January 1985, a pair of middle convex high precision mirror surface press rollers was successfully machined. The overall length of these press rollers was 2300mm; the operation sector of the roller was OD360x1100mm. The article describes the technical process.

1. Initial grinding and forming

First, the specified geometric dimensions were ground at a press roller grinding machine; the middle convex value is between

0.05 and 0.06mm, and the surface coarseness is R_a0.8μm(▽8). After being qualified in inspection, the curve coordinate was traced to determine the distance and the positions of the fixed-point measurement for checking in inspection and acceptance of the finished products.

2. Electric brush coating

1) First, pretreatment of the machined surface was carried out: this is a key sector for cast iron material. This process included the operation and treatment of 13 work steps: cleaning, oil removal, preheating, drying, electrostatic treatment, and activation (among others); this process occupied more than one-half of the total machining operation time. In addition, the operation requirements are relatively strict, fast and precise without interruptions. Owing to many solvent types for pretreatment, the operation should be conducted according to the specified parameters and norms on the revolution speed of the workpiece, poleward current, variations of voltage, duration of electricity and conduction time, and relative feed speed of graphite anode, among others. As analyzed from the metallographic pictures of cast iron material, owing to the different forms of carbon steel structure, especially the existence of carbon molecules and microscopic holes of cast iron, there is a strong relationship with binding strength at the beginning of coating of the coating layer. If the carbon cannot be better removed, and the removed acidic solvent in the microscopic holes cannot be well cleared, coating will not be effective at the beginning of coating. Thus, microscopic gas bubbles are generated in the coating layer, or coating layer stripping due to cracks at certain thickness of the coating layer.

2) Brush coating operation layer: after the surface pretreatment, wiping without electricity (alkaline nickel or

rapid nickel) should be conducted as fast as possible: this has a very important bearing on the binding strength of the coating layer. Wiping without electricity can have the three following functions:

(1) Predeposition of metal ions on the coated surface.

(2) The ph values tend to be constant on the workpiece surface.

(3) The friction of machinery and the chemical function of the coating fluid can remove the microscopic oxides generated between the work steps.

After completing the wiping without electricity, electroconduction with brush coating should be quickly applied. In this process, attention should be paid to see that the coating fluid should cover the entire workpiece or separate it from the environmental air. There should be no bearing of the workpiece to be coated, and sufficient coating fluid should be supplied. The graphite anode used in brush coating was a large anode especially ordered in Shantong Province; the width of the anode was 200mm, the radius of the circular arc was 180mm, and the chord length was 230mm. The coating fluid was supplied by a centrifugal pump with a high flow rate. In the entire process coating, consistent attention should be paid to the temperature of the workpiece, coating fluid and the anode to be maintained in the range between 40 and 50^{o}C. Moreover, attention should be paid at all times to the wearing situation of the graphite anode and its envelope, maintaining a uniform feed speed (20 to 27m/min), appropriate and uniform contact stress, and satisfactory matching. If it is discovered that the envelope has teaseling wear, or infiltration of carbon black, such places should be changed or repaired in time.

3. Grinding with abrasive belt and buffing

Based on the practice of the author's plant of licensing the grinding technique with an abrasive belt, and the conditions of the available equipment, the author tried to machine the mirror surface of a press roller by adopting grinding with an abrasive belt and buffing with a C630 lathe.

After completing the brush coating, first the surface of the workpiece was lightly ground to smooth the sharp edges with water abrasive paper (Nos. 500 to 1000) and a hone (Nos. 320 to 400). The purpose was to eliminate the surface stress of the coating layer and to prevent the generation of cracks during machining. Then the clamping precision of the press roller was inspected and aligned and the diametral direction jumping tolerance was controlled to within 0.01 to 0.02mm and then grinding machining was able to proceed.

During grinding, based on the machining situation, an abrasive belt was selected with granularity of No. 60, No. 80, and No. 120, workpiece revolution speed n=18r/min, abrasive belt linear speed v=33.6m/s, feed s=15mm/min, and cutter feed pressing t=0.1 to 0.2mm. From spark feed grinding to sparkless grinding, the surface coarseness can be brought to below the value $R_a 0.4\mu m$. To ensure the precision of geometric dimensions of the curved surface of the convex-shaped press roller, measurements should be made at all times during machining in order to adopt calibration measures for dimensional compensation. Measurement applies the measures of equal distance segmented fixed points and the arithmetic mean displacement contrast coordinate for point tracing.

After being qualified with precision machining of geometric dimensions of the press roller surface, buffing was begun. During buffing, the abrasive belt was replaced with a cloth

wheel; there are two steps in buffing: crude and precise. During crude buffing, white corundum grinding compound was used with granularity of M20, M14, and M10 to be made into a paste with machine oil. During precise buffing, green chromium oxide was used as the grinding compound with granularity of M10, M7, and M5; the grinding compound was blended with machine oil and kerosene. The cloth wheel used in buffing should have crude and precise cloth wheels. After buffing, the workpiece surface gradually became a mirror surface. Finally, after measurement and point tracing, the geometric dimensions of the surface can attain the requirements of the user plant; the middle-convex value was 0.05mm.

This pair of press rollers was installed and operated beginning on March 19, 1985, at a user plant; the press rollers still operated normally on August 25, 1985. The quality of the plastic film products were appreciably upgraded with satisfactory results.

The press roller is hollow inside; during operation, superheated steam was led in. For rust prevention on the press roller not yet coated with nickel, machine oil was deposited on the surface when not in operation; when the press roller is about to operate, the machine oil should be wiped clean. However, after nickel coating, machine oil was not applied in the absence of any rust. Corrosion-proofing and grinding proofing can prolong the service life.

Finally, one point of explanation is in order. To ensure successful experiments, the authors used plastic transparent film to separate the space above the work site from the environment to smoothly proceed with brush coating and machining.

(Zhou Furong, editor)

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